

# Dynamic Control System Mode Performance of the Space Technology-7 Disturbance Reduction System

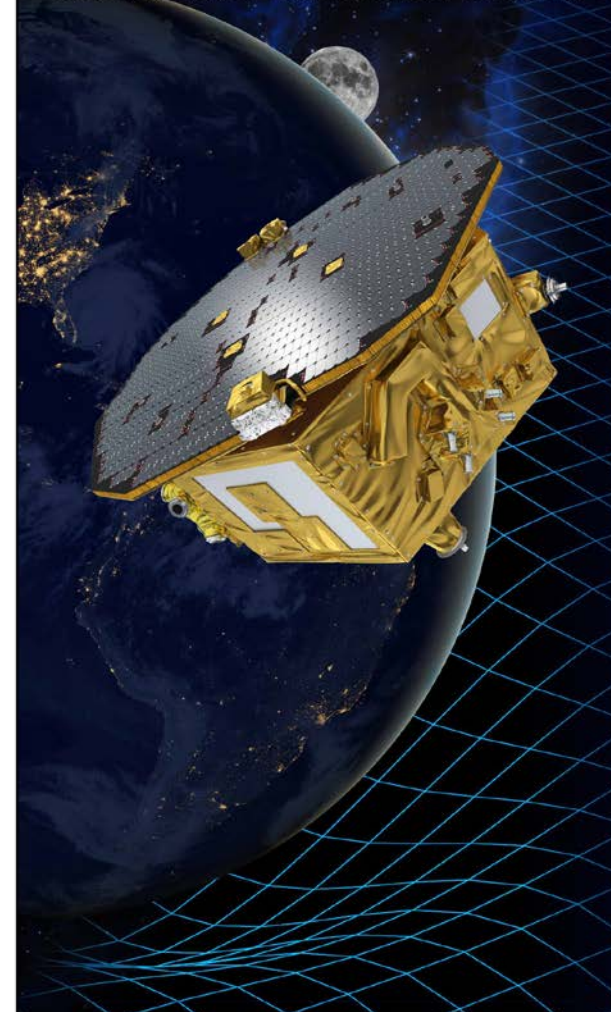
James R. O'Donnell Jr.  
Oscar Hsu  
Peiman Maghami

National Aeronautics and  
Space Administration



# ST7-DRS

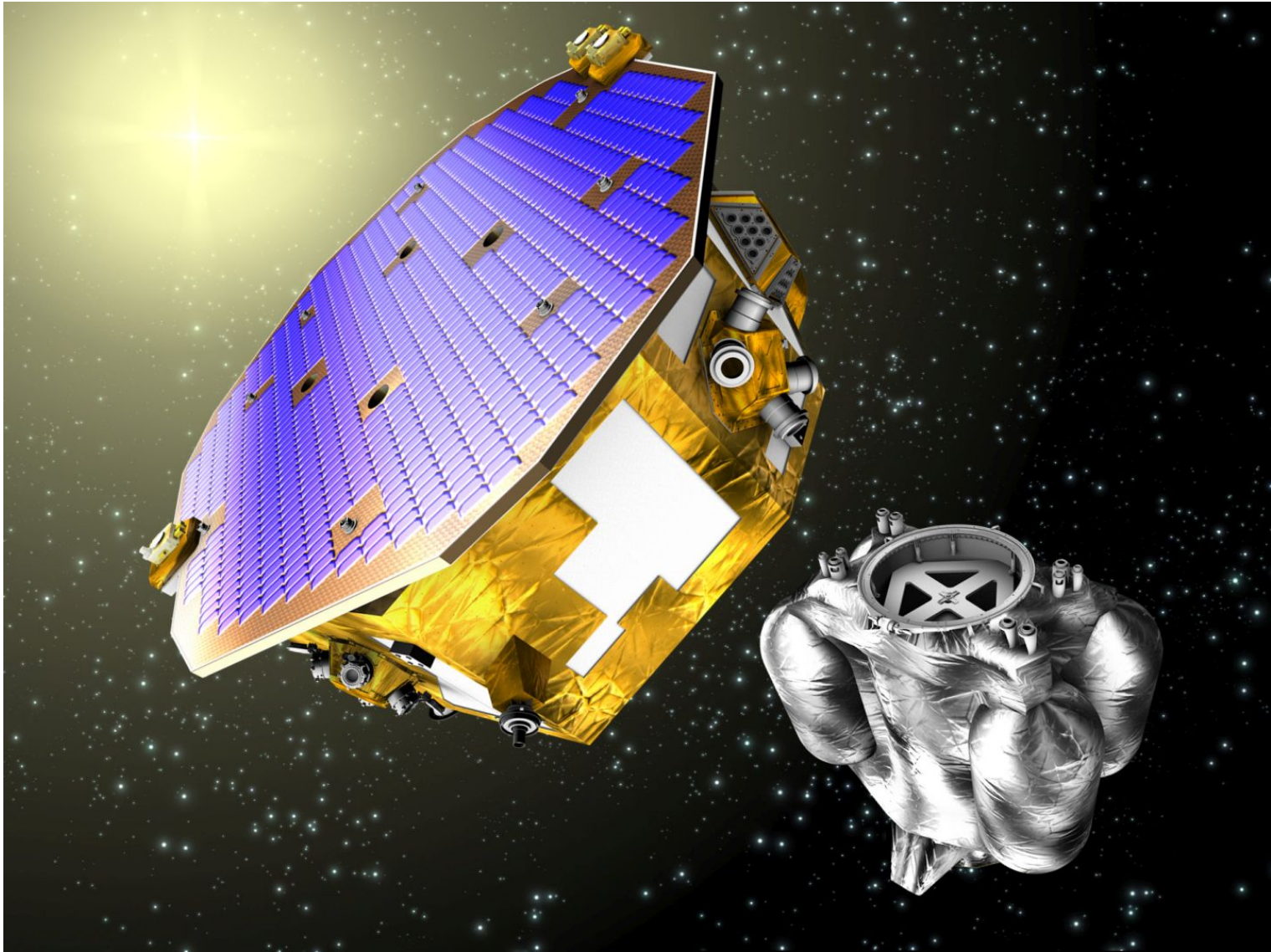
**SPACE TECHNOLOGY 7**  
DISTURBANCE REDUCTION SYSTEM



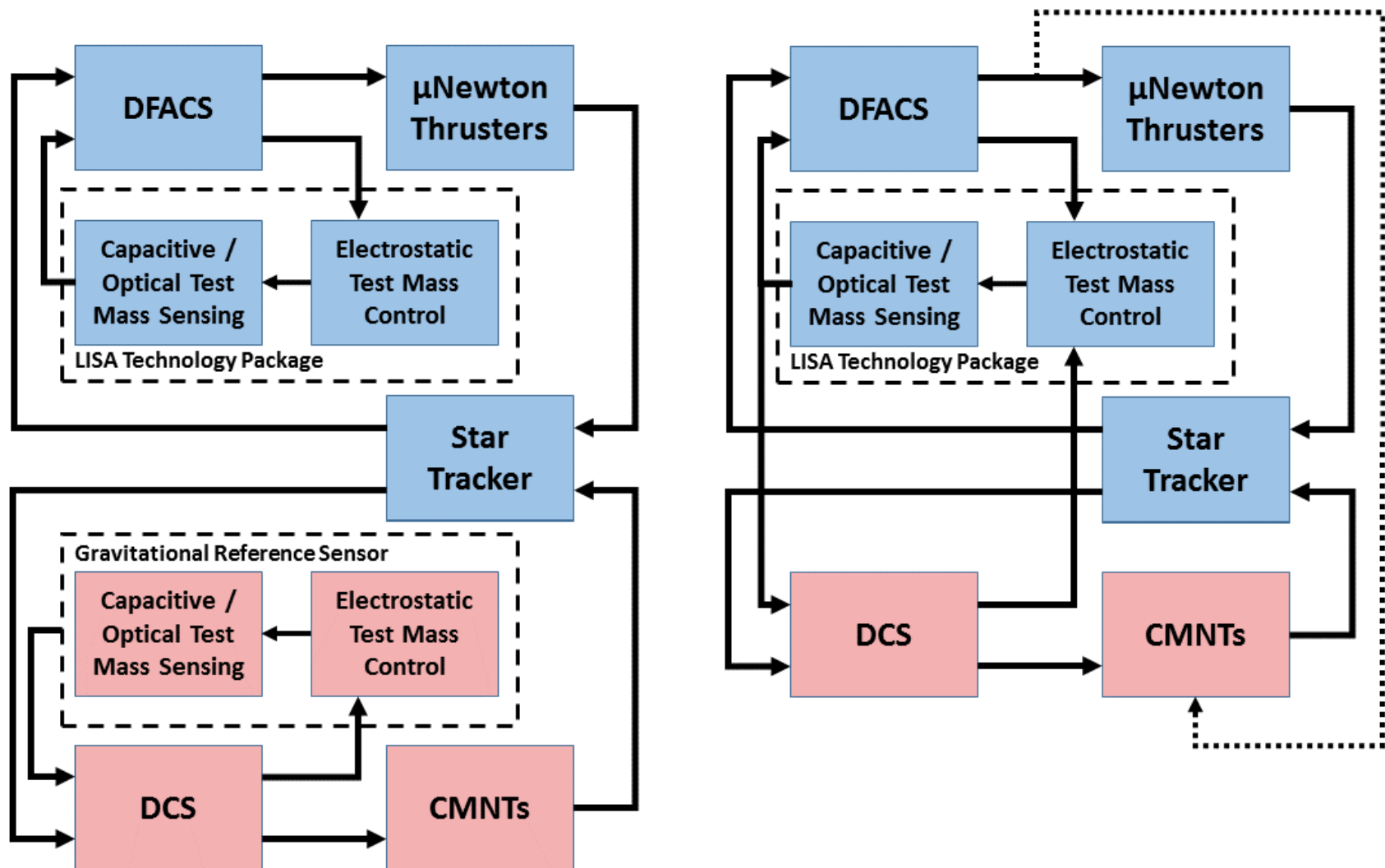
# Outline

- Introduction
- LISA Pathfinder/Disturbance Reduction System (DRS)  
Initial and Final Configuration
- DRS Dynamic Control System (DCS) Mode Design
- DCS Mode Performance
- Conclusion and Acknowledgements

# Introduction



# LPF/DRS Initial and Final Configuration

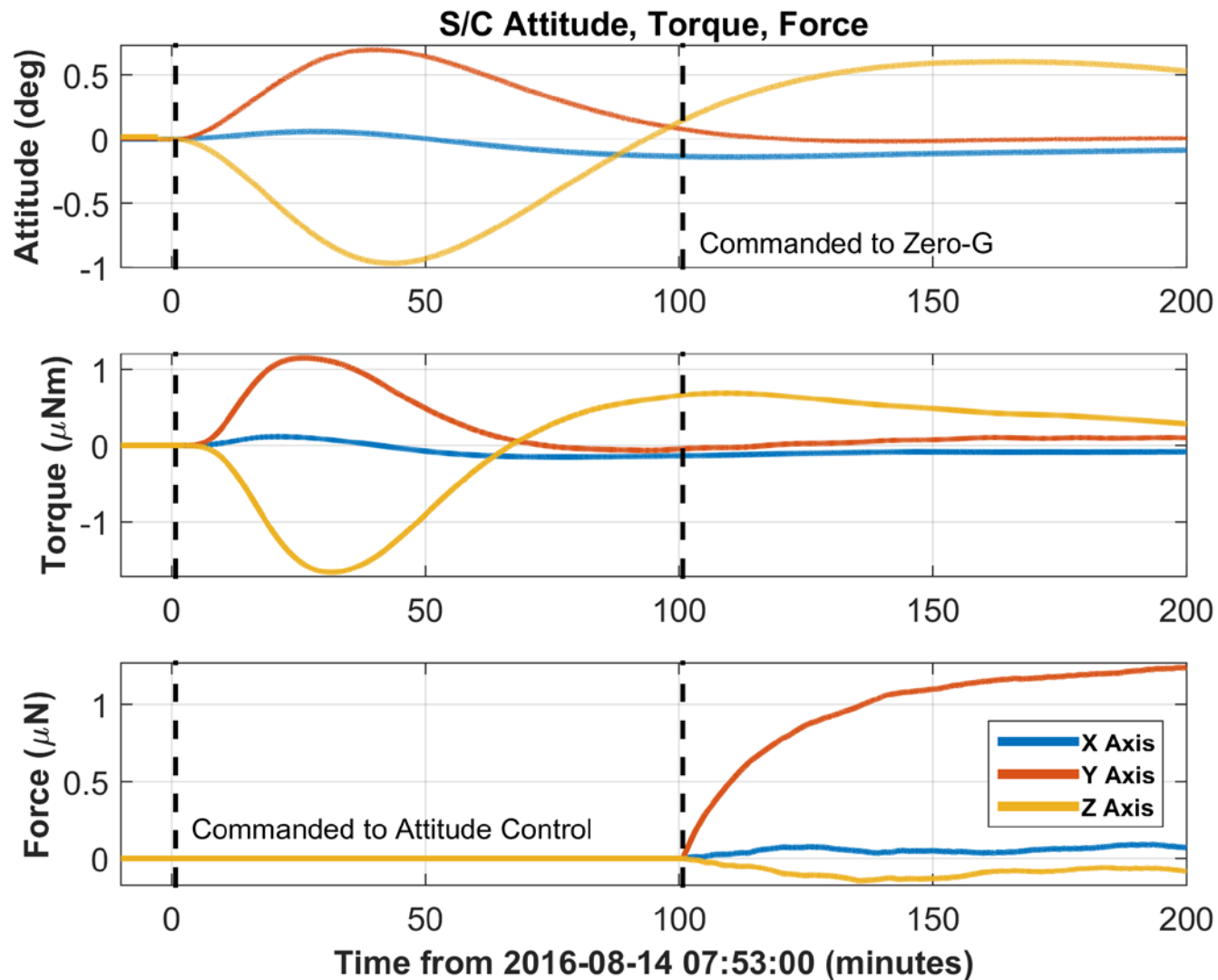


# DCS Control Mode Design

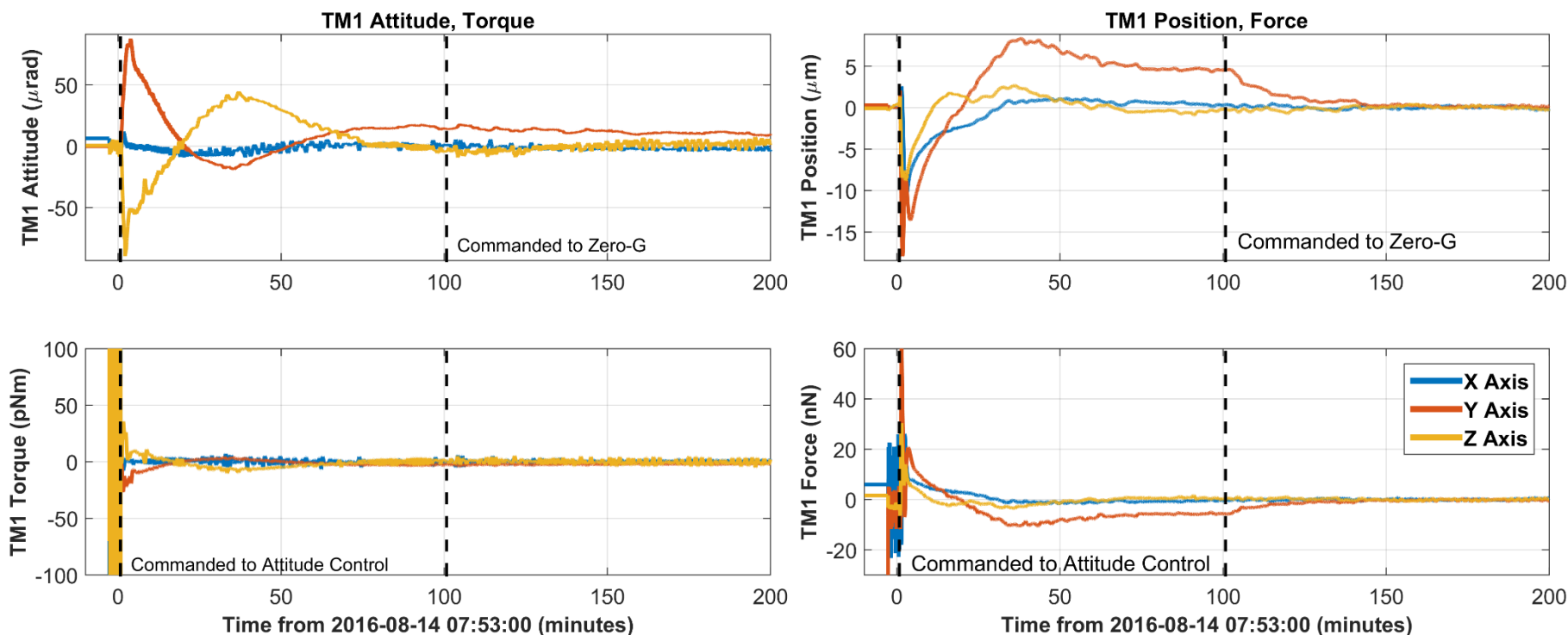
DRS Mission Mode	Spacecraft Control Mode	Reference Test Mass Control Mode	Reference Test Mass Force Mode	Non-Reference Test Mass Control Mode	Non-Reference Test Mass Force Mode
Standby	Standby	DFS Standby	N/A	DFS Standby	N/A
Attitude Control	Attitude-Only	DFS Accelerometer	High Force	DFS Accelerometer	High Force
Zero-G	Accelerometer				
Drag Free Low Force	Drag Free 1	DFS Drag Free 1	Low Force	Suspended Drag Free 1	Low Force
18-DOF Transitional					
18-DOF	Science	DFS Drag Free 2		Suspended Drag Free 2	



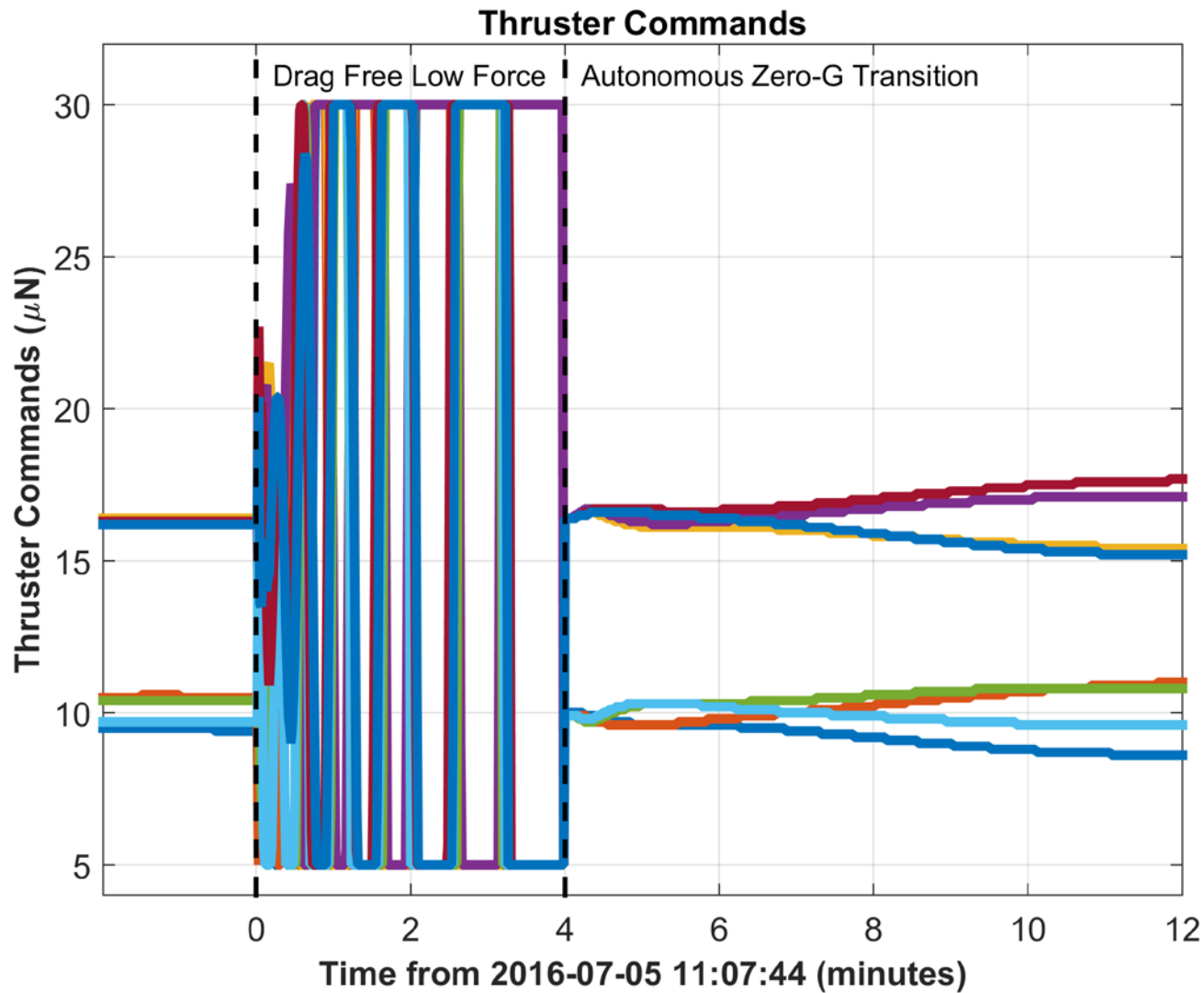
# Attitude Control and Zero-G: Spacecraft



# Attitude Control and Zero-G: Test Mass 1



# Initial Drag Free Low Force Test





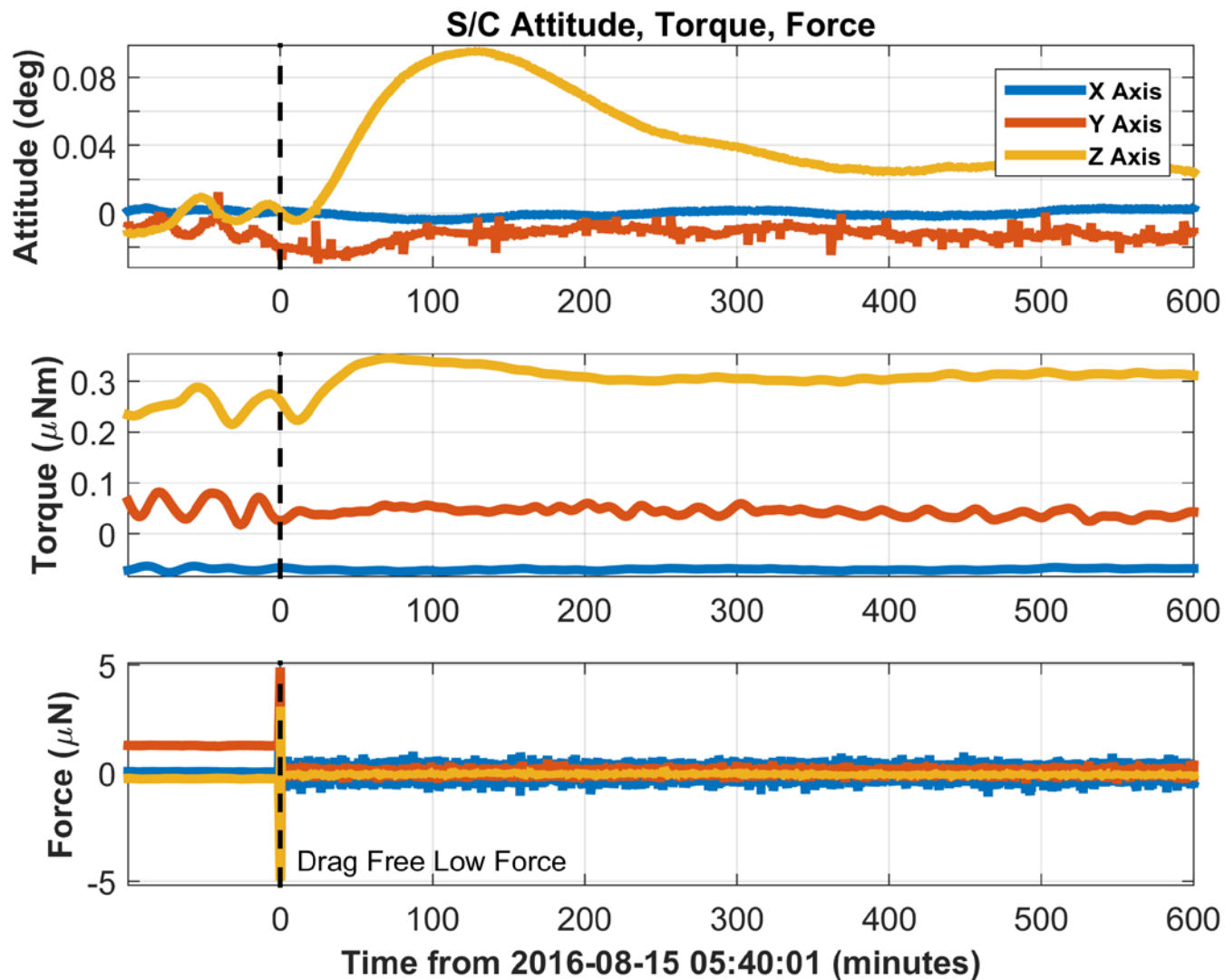
# DCS Control Mode Design

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18-DOF Transitional				Suspended Drag Free 2	
18-DOF	Science	DFS Drag Free 2			

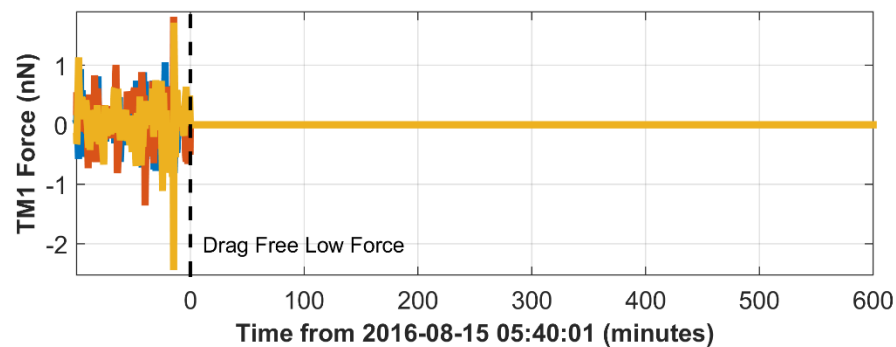
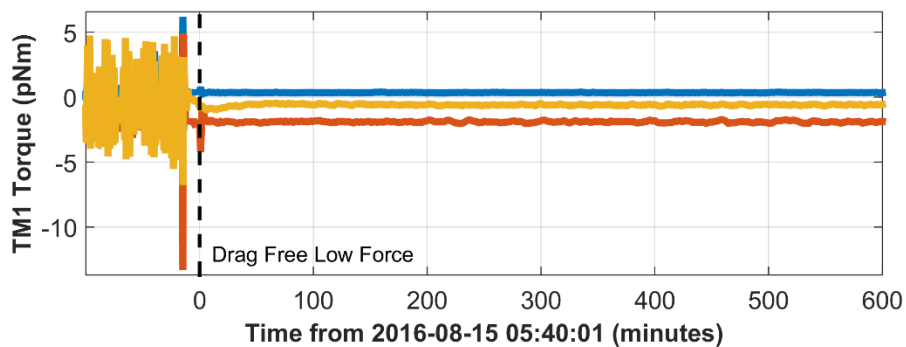
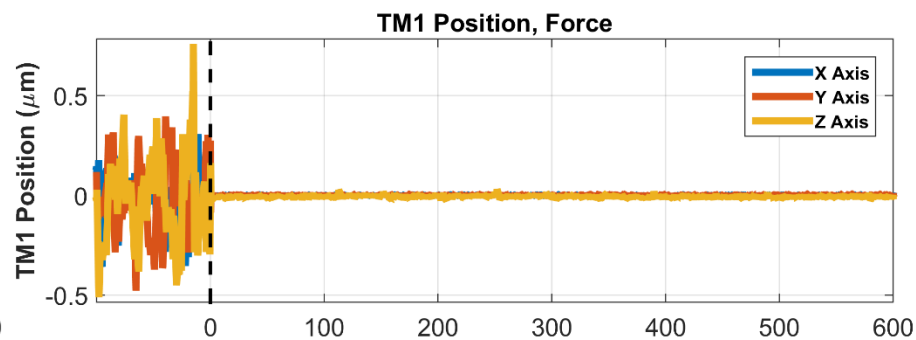
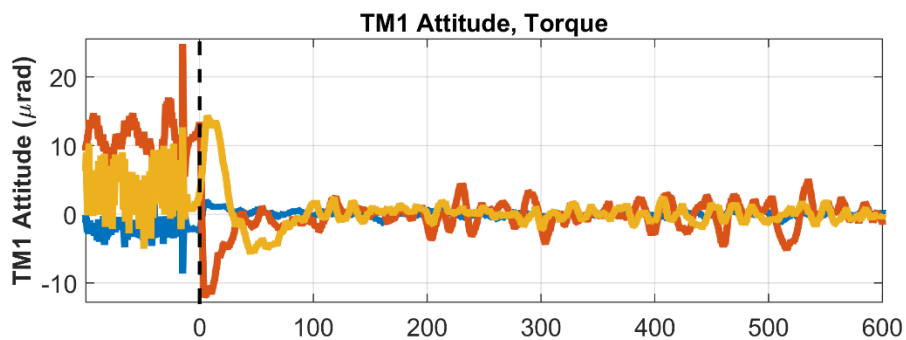
# Test Mass Control for Drag Free Transition

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18-DOF	Science	DFS Drag Free 2		Suspended Drag Free 2	

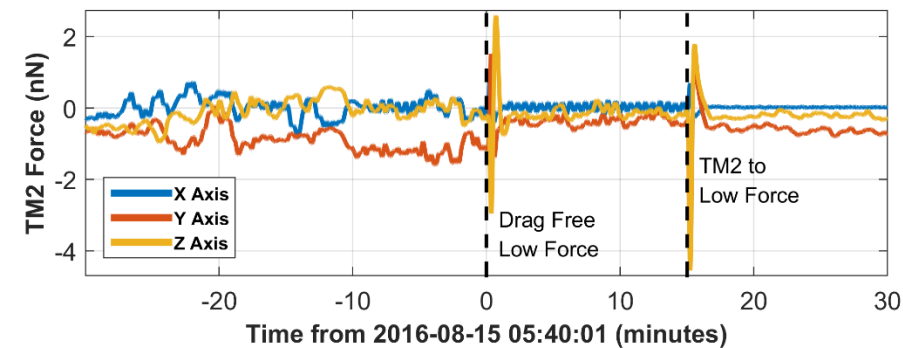
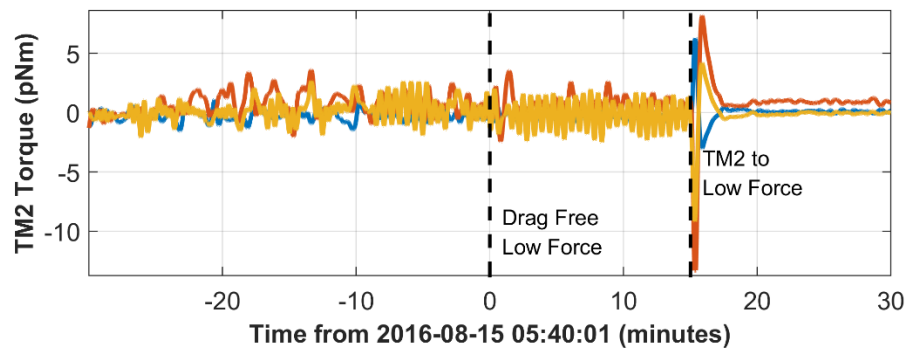
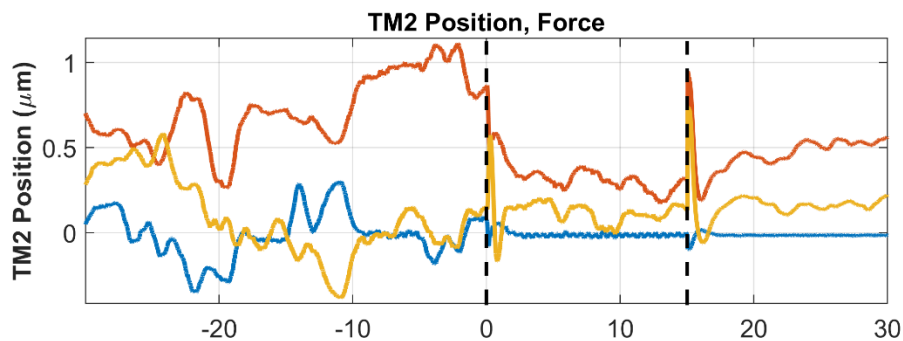
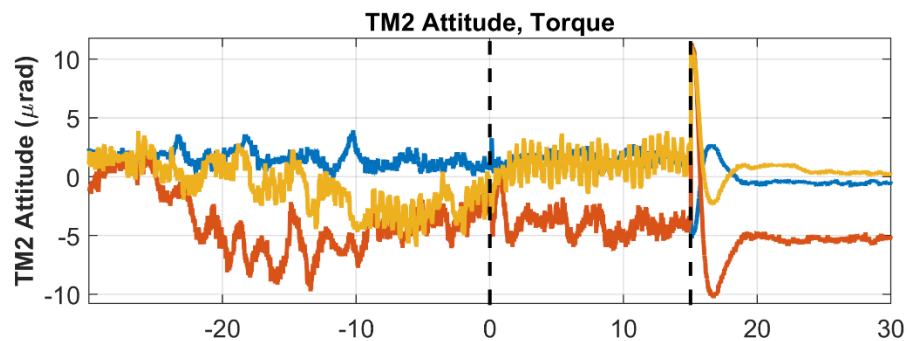
# Drag Free Low Force: Spacecraft



# Drag Free Low Force: Test Mass 1



# Drag Free Low Force: Test Mass 2



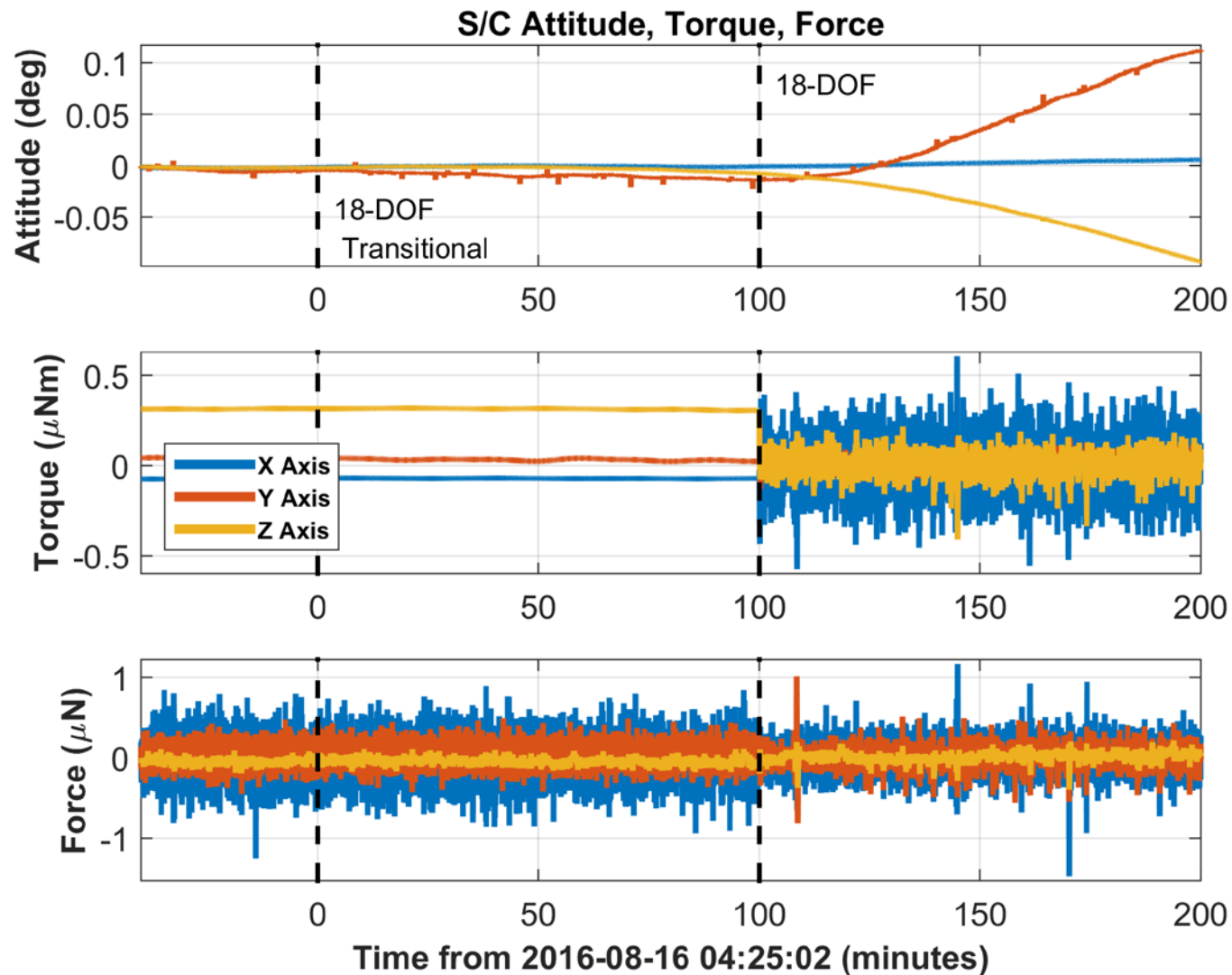
# Spacecraft/Test Mass Control Mode Design



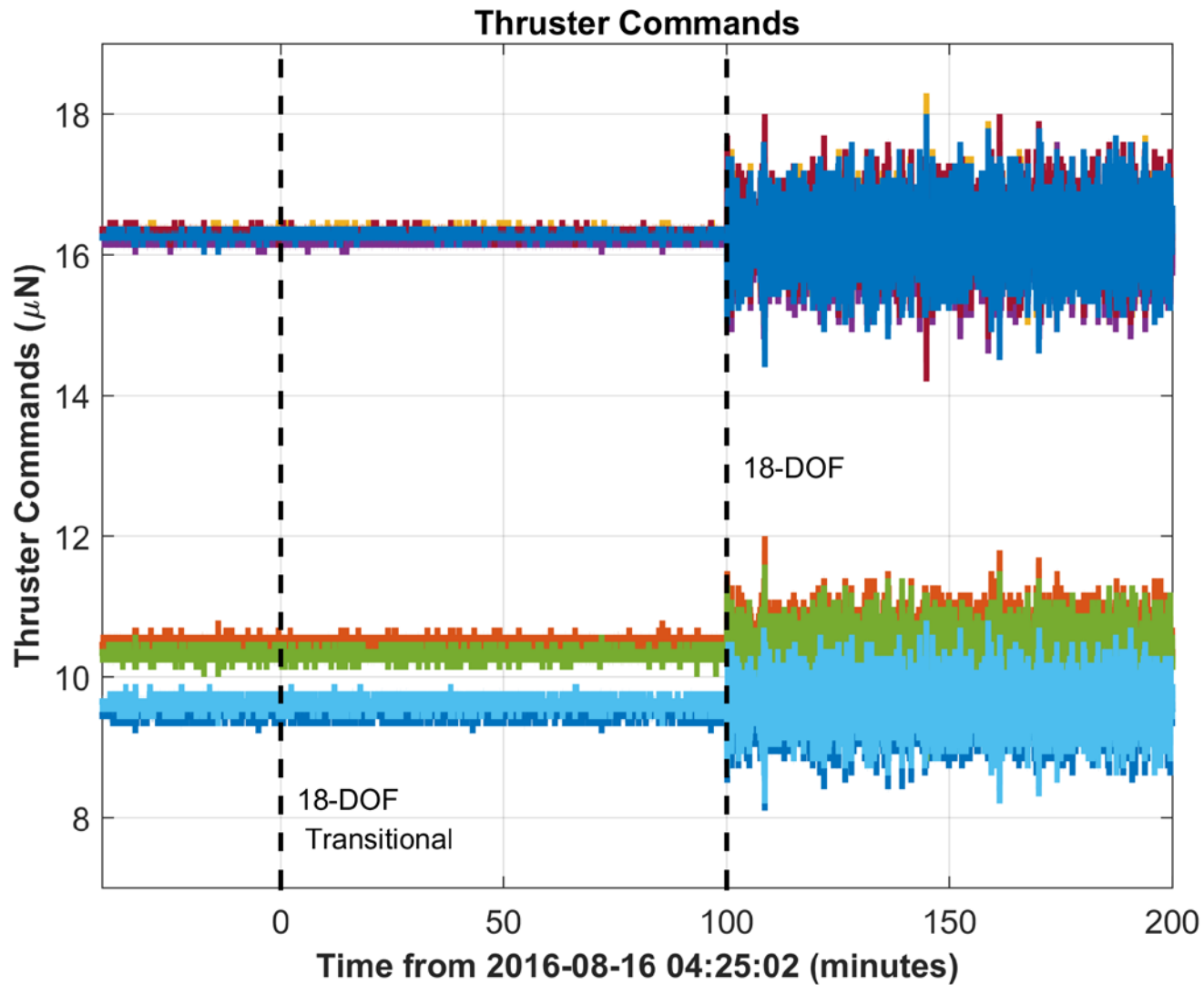
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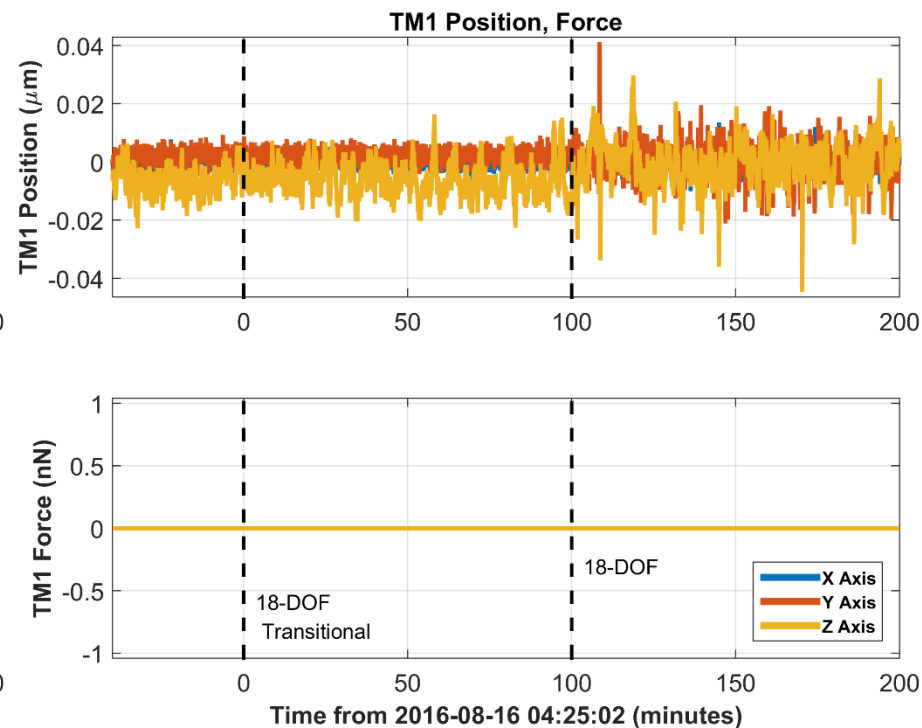
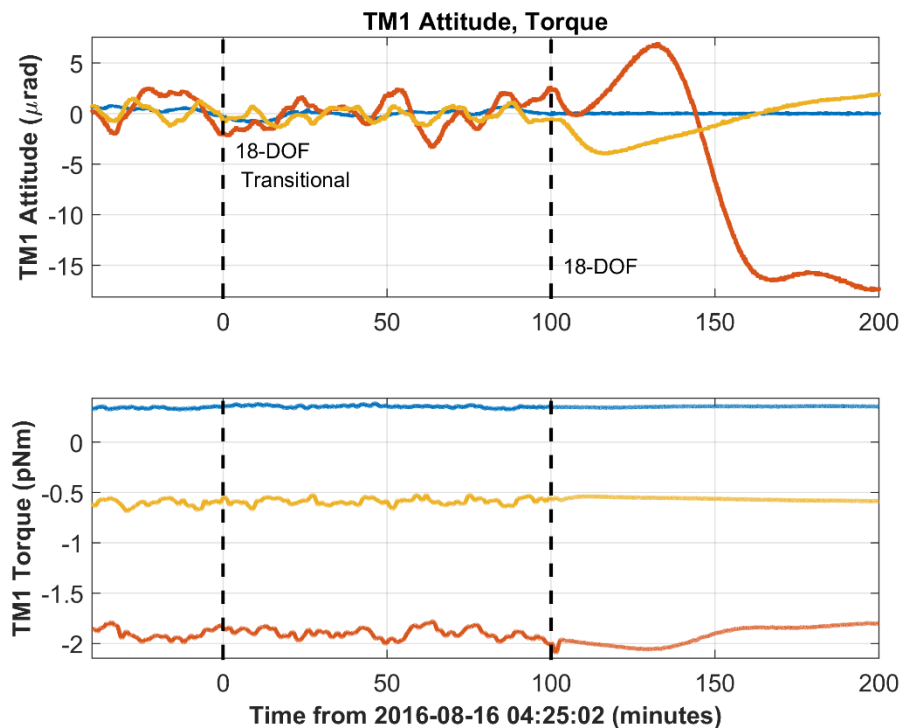
# 18-DOF: Spacecraft



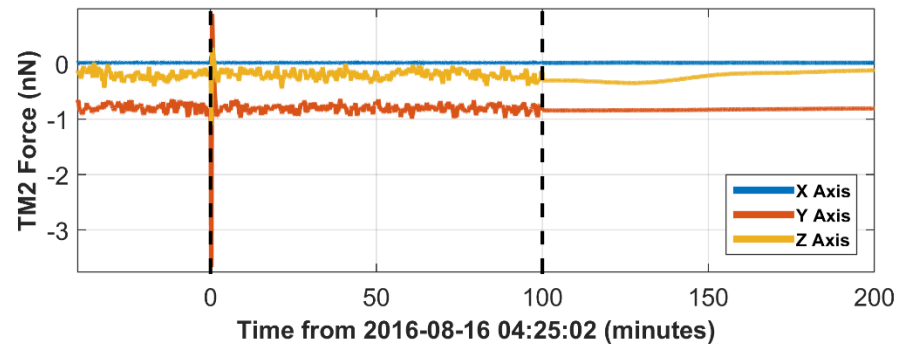
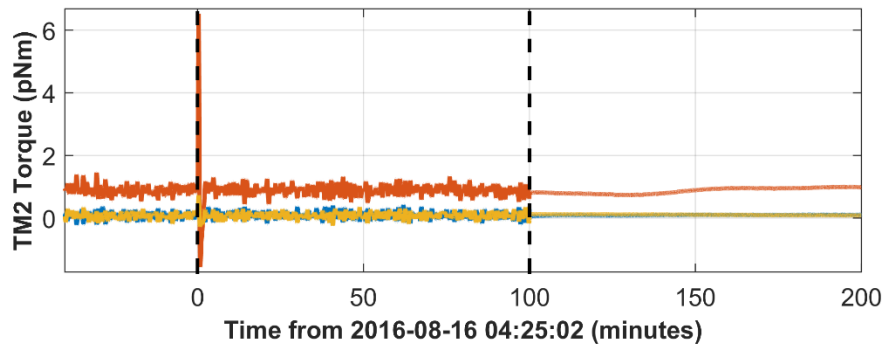
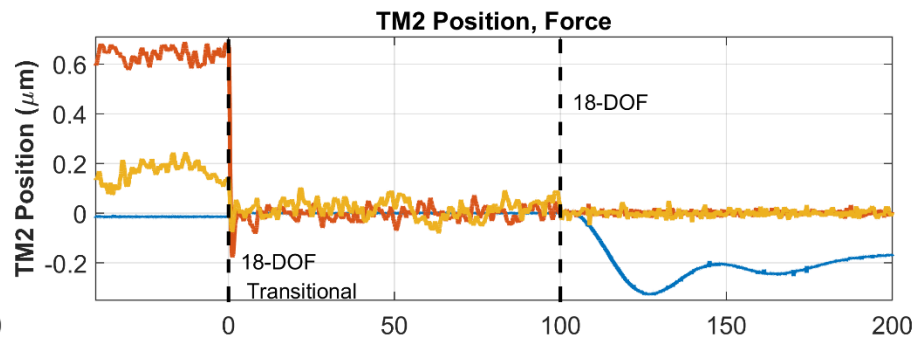
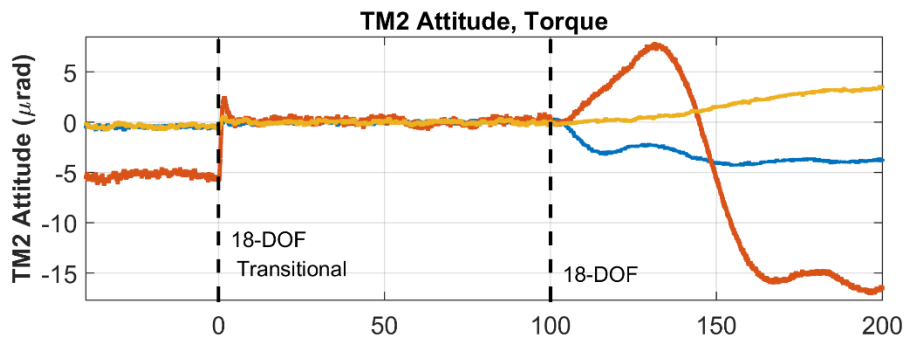
# 18-DOF: Thruster Commands



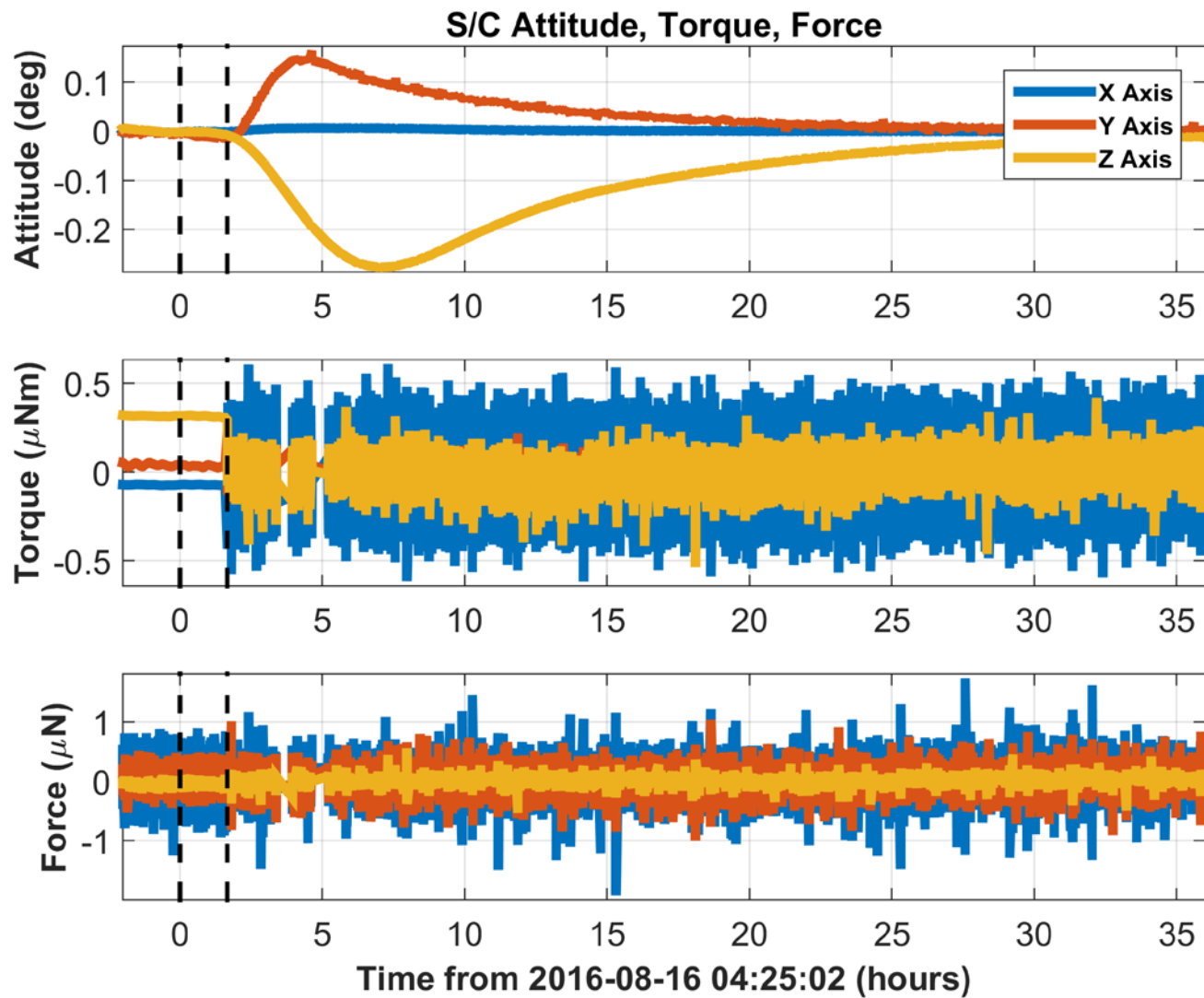
# 18-DOF: Test Mass 1



# 18-DOF: Test Mass 2



# 18-DOF: Spacecraft

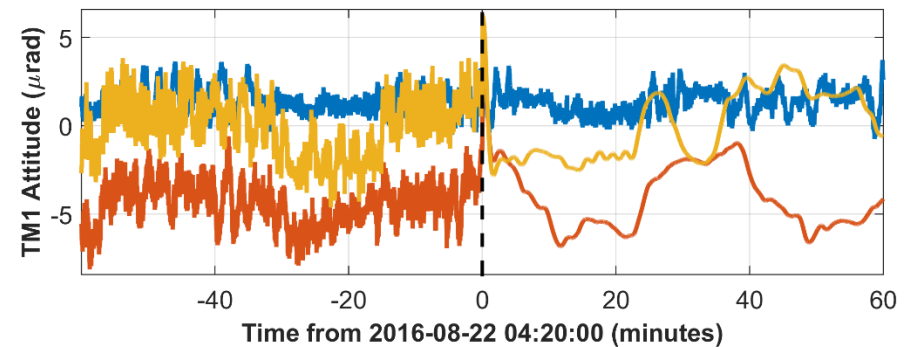
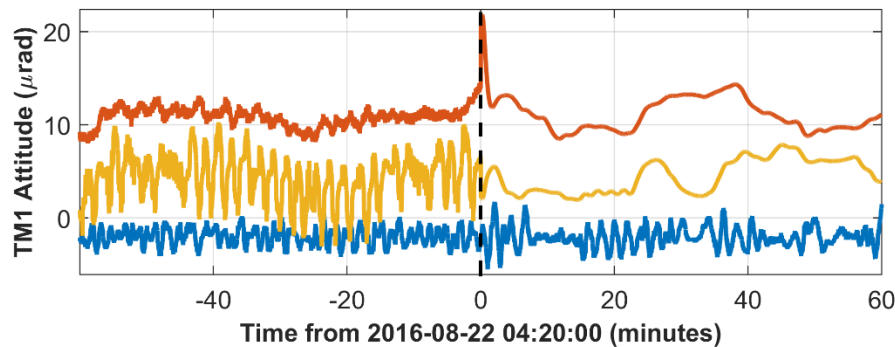
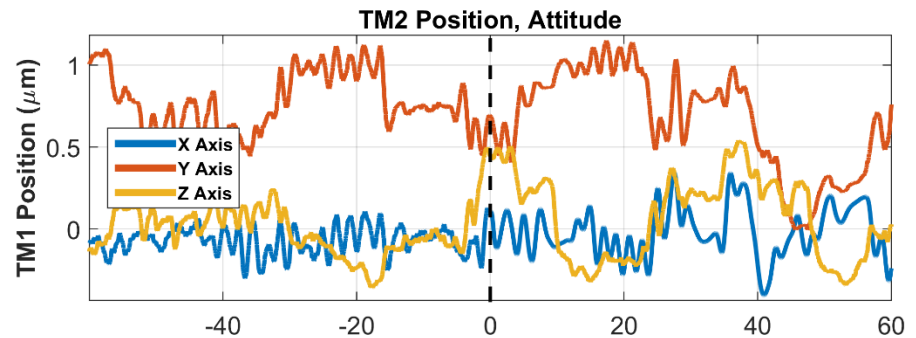
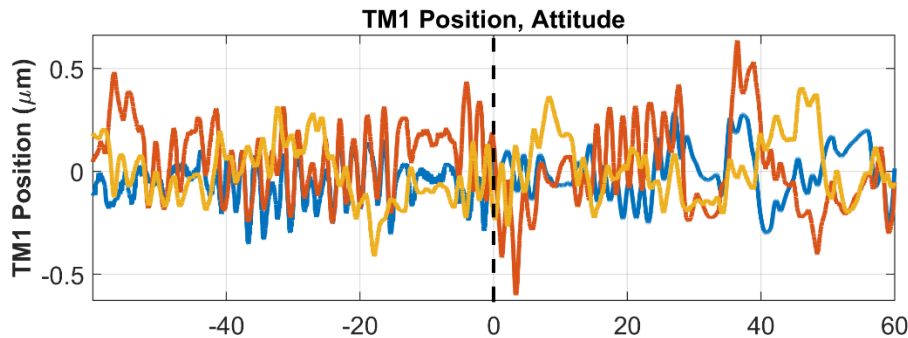
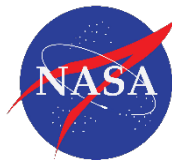


# DCS Control Mode Design

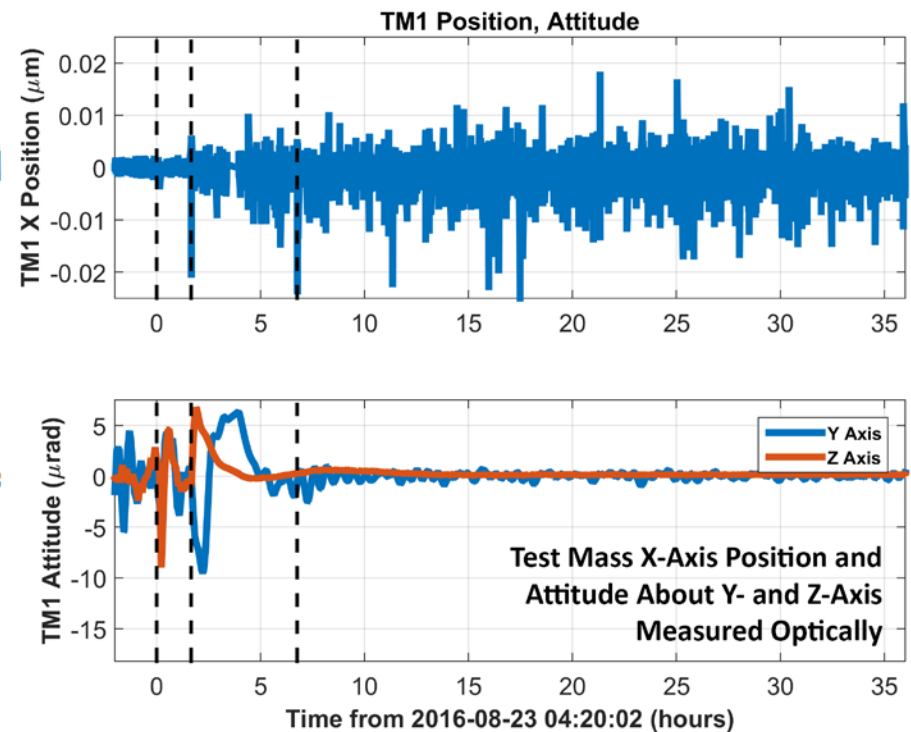
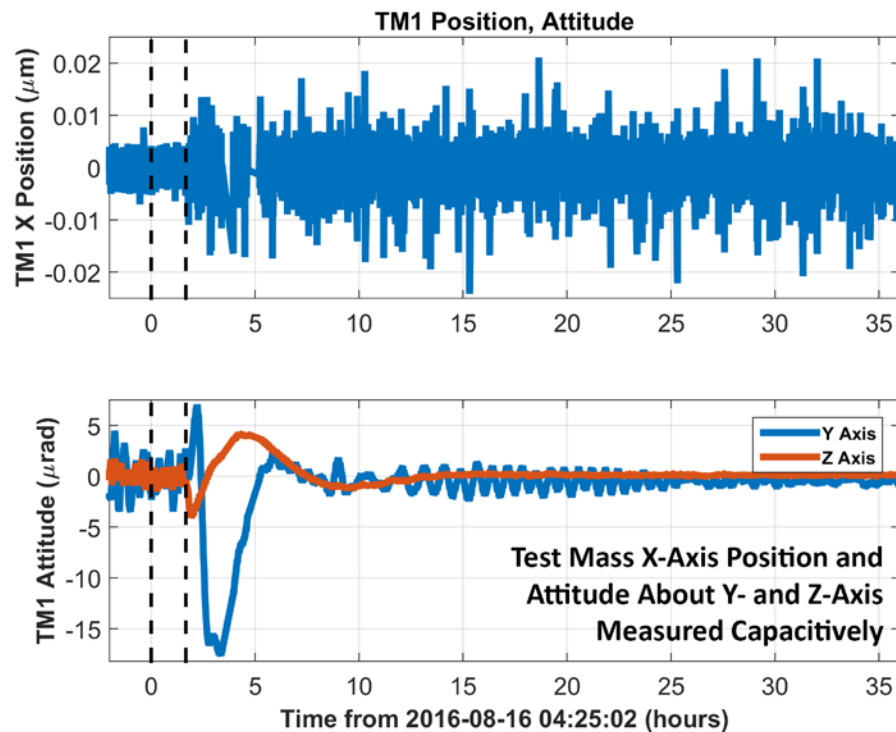
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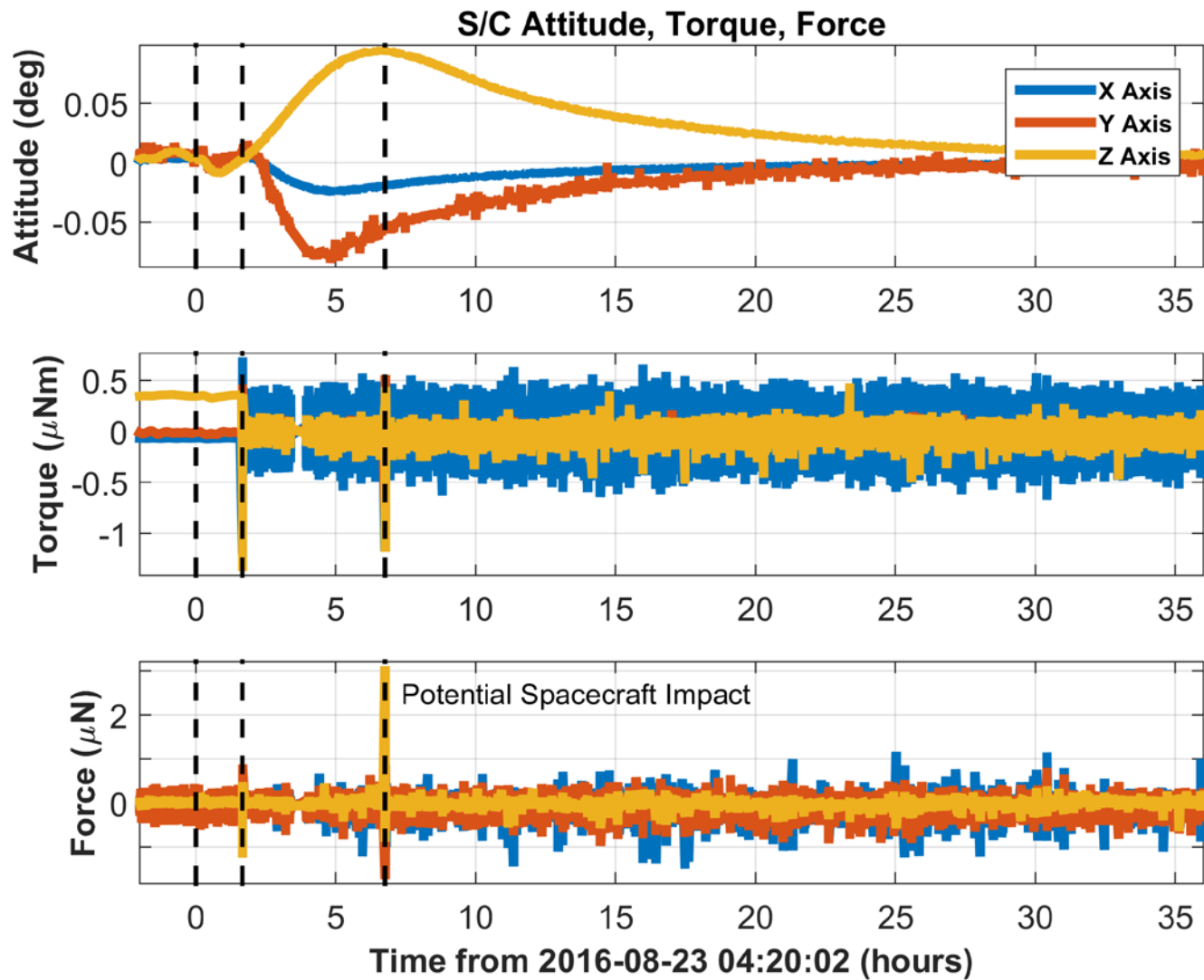
# Optical Metrology System Measurements



# 18-DOF w/OMS: Test Mass 1



# 18-DOF w/OMS: Spacecraft



# Conclusion

The Disturbance Reduction System and the Dynamic Control System met all of their requirements and supported the evaluation of the performance of the Colloidal MicroNewton Thrusters. With only a few exceptions, all control modes performed nominally, with good robustness characteristics. In the few instances where there were problems, the DCS team was able to very quickly provide adjustments to control system parameters to fix them.

# Acknowledgements

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